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Established 1859 Pioneer of the Gas Industry

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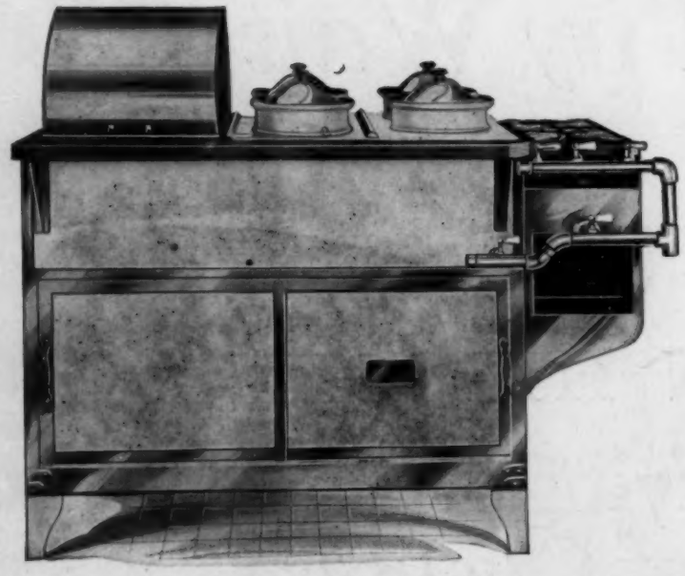
A Complete Line of GAS APPLIANCES

for the cooking and serving of food



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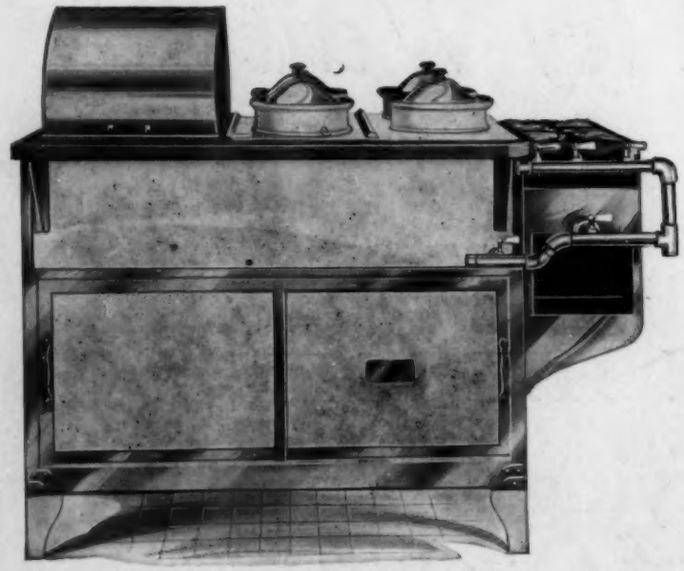
for the cooking and serving of food



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American Gas Journal

SIXTY-SEVENTH YEAR

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AMERICAN
GAS JOURNAL

Established 1859—Pioneer of the Gas Industry

Vol. 124. No. 16 NEW YORK, APRIL 17, 1926 Whole No. 3572

Gas Manufacture for Peak Load Conditions*

Application of fundamental principles to a typical situation

E. L. Hall

General Superintendent, Portland Gas & Coke Co., Portland, Ore.

FOR purposes of illustration, the city of Portland, Oregon, has been chosen because of the writer's familiarity with the conditions in that city.

The following tabulation for 1924 shows the number of days on which a certain number of millions of cubic feet were sent out. The load percentage and the accumulative number of days above a given send-out requirement are also shown:

Table A

	6-7	7-8	8-9	9-10	10-11	11-12	12-13	13-14	14-15	15-16	16-17	17-18	18-19	19-20	20-20	21-22	22-23	23-24	24-25	25-26
Load Factor %	25	29	33	37	41	45	49	52	56	60	64	68	72	76	80	84	88	91	95	100
Jan. 31				1	1	13	7	2	2	1	4									
Feb. 29				4	20	4	1													
Mar. 31				1	13	13	4													
Apr. 30		1	2	10	13	3	1													
May 31	2	6	17	5	1															
June 30	2	2	17	8	1															
July 31	2	5	18	6																
Aug. 31		5	20	6																
Sept. 30		1	9	12	8															
Oct. 31			1	8	15	5	2													
Nov. 30					2	4	9	12	3											
Dec. 31						2	4	5	5	3			1	2	2	3	1	1		2
T'tal 366	6	20	84	61	74	44	28	19	10	4	4	0	1	2	2	3	1	1	0	2
Accu'tive	366	360	340	256	195	121	77	49	30	20	16	12	12	11	9	7	4	3	2	2

This table shows very clearly the relative weight of each daily load, the minimum load of 6 to 7 million cubic feet occurring on six days throughout the year, a maximum daily load of 25 to 26 million cubic feet occurring on two days of the year, and an 8 to 9 million load occurring the maximum number of times on 84 days of the year.

Another Table

Another table (B) has been made, from which may be derived the percentage of the year that a certain percentage of plant capacity was required. Thus 72% of the plant took care of all but twelve days of the year, making 28% of the plant investment chargeable to twelve days, or 3.3% of the year, 48% of the plant investment chargeable to 49 days or 13.4% of the year, and so on.

* Second part of Mr. Hall's article, continued from the April 10th issue.

Table B

Send out	% of Max. Plant Capacity	No. of days this send-out was equalled	% of year
25-26 million	100	2	0.5
24-25 "	95	2	0.5
23-24 "	91	3	0.8
22-23 "	88	4	1.1
21-22 "	84	7	1.9
20-21 "	80	9	2.5
19-20 "	76	11	3.0
18-19 "	72	12	3.3
17-18 "	68	12	3.3
16-17 "	64	16	4.4
15-16 "	60	20	5.5
14-15 "	56	30	8.2
13-14 "	52	49	13.4
12-13 "	49	77	21.1
11-12 "	45	121	33.2
10-11 "	41	195	53.4
9-10 "	37	256	70.0
8- 9 "	33	340	93.0
7- 8 "	29	360	98.5
6- 7 "	25	366	100.0

The gas plant at present consists of an oil gas plant of about 30 million cubic feet capacity. By-products are recovered consisting of briquetted lampblack, tar and benzol, which latter is sold principally for motor fuel. From these by-products very large revenues are obtained, as a credit to oil gas operation, all of which tends to favor oil gas as compared with coal gas more than would be the case in other situations where by-products have not been developed to a like extent, the result of which would naturally be that Portland can stay with oil gas for correspondingly higher prices for oil.

The effect of the foregoing considerations has been applied to the Portland situation and shows:

1st: The effects in changes of the heat value of the gas.

2nd: The effect of changes in specific gravity of the gas, and

3rd: The effect of specific gravity and heat value in the gas, all of which has been expressed in the cost per therm.

Effects of Changes in Heat Value of Gas

With a given heat requirement, the volume of gas to be supplied varies inversely with the heat value of the gas. The effects of changes in heat value of the gas are therefore effects due to the greater or lesser volume of gas.

Conditions beyond the works storage holder which are affected by changes in volume to be distributed may be listed as follows:

1. Gas storage capacity.
2. Compressor capacity and operation.
3. Transmission and distribution mains, and service connections.
4. Meter capacity.
5. Readjustment of appliances.

These items will be discussed in turn, taking as a basis the capacity of the present equipment.

Effect on Storage

The present storage capacity is estimated to be sufficient for a yearly sendout of 5,000,000,000 cu. ft. under conditions of load factor now existing. The capacity is about 11,200,000 cu. ft. and cost (at $125/M) about $1,400,000. At 15% per annum for all charges this storage costs $210,000 per year or $0.042 per M (on basis of 5 billion cu. ft.).

Assuming that the present ratio of storage to sendout will be adequate for the projected plant, the effect on storage of change in B. t. u. value is readily calculated by simple proportion. The cost per M remains constant at $0.042 and the other figures will vary as shown in the following table:

Heat Value B.t.u.	Storage Reqd. Cu. ft.	Investment Dollars	Cost per Year Dollars (15%)	Cost per Therm Dollars
350	18,250,000	2,280,000	342,000	0.01200
400	16,000,000	2,000,000	300,000	0.01050
450	14,200,000	1,750,000	262,000	0.00933
500	12,800,000	1,600,000	240,000	0.00839
550	11,600,000	1,450,000	218,000	0.00763
570	11,200,000	1,400,000	210,000	0.00737
600	10,600,000	1,325,000	199,000	0.00700

Effect on Compressor Capacity and Operation

Under conditions such as now obtain; viz., yearly pressure average of 15 lb. gauge, 20,000,000 cu. ft./day compressors, 30% load factor, the cost of compressing the gas is about $0.0135 per M. This will remain very nearly the same regardless of the analysis of the gas; the volume pumped however will vary inversely with the heat value.

The following table summarizes the effects:

Heat Value B.t.u.	Compr. Capy. Reqd. (daily)	Investment Dollars	Cost per Year Dollars	Cost per Therm Dollars
350	65,100,000	423,000	96,200	0.00386
400	57,000,000	371,000	84,200	0.00337
450	50,700,000	329,000	74,800	0.00300
500	45,700,000	296,000	67,400	0.00270
550	41,400,000	269,000	61,300	0.00245
570	40,000,000	260,000	59,200	0.00237
600	38,000,000	247,000	56,200	0.00225

This, of course, is approximate only, since actually the change in plant capacity would be made in steps and costs would vary irregularly and would change as the excess capacity is more and more fully utilized.

About one-third of the gas is at present repumped and distributed at high pressure. Owing to the use of electric power and higher pressures, the unit cost of this repumping is higher than the preceding. About $0.04 per M is the present cost for 570 B. t. u. gas. One-third of $0.04 = $0.0133 or a charge on the total gas very nearly equal to that due to compression at the works.

Transmission and Distribution Mains and Services

The present investment under this head is about $5,500,000 and may be considered adequate for about 5,000,000,000 cubic feet annual output. Taking fixed charges at 12% this makes $0.132 per M as the cost of distribution chargeable to mains and services. Of this, possibly 25% would be adequate regardless of the heat value of the gas. On this basis the following table indicates what may be expected:

Heat Value B.t.u.	Capacity M/Year	Investment Dollars	Cost per Year Dollars	Cost per Therm Dollars
350	8,150,000	8,095,000	972,000	0.0341
400	7,130,000	7,255,000	871,000	0.0305
450	6,340,000	6,605,000	793,000	0.0278
500	5,710,000	6,085,000	730,000	0.0255
550	5,180,000	5,655,000	679,000	0.0238
570	5,000,000	5,500,000	660,000	0.0232
600	4,750,000	5,295,000	635,000	0.0223

Meter Capacity

Taking total number of meters installed at 105,000, governors at 26,000, estimating that half of these will be sufficient in capacity regardless of any change in heat value, that present capacity is sufficient for 5,000,000 M per year of 570 B. t. u. gas, and that fixed charges and maintenance amount to 17%, we have the following table:

Heat Value B.t.u.	Capacity M/Year	Investment Dollars	Cost per Year Dollars	Cost per Therm Dollars
350	8,150,000	1,736,000	295,000	0.01287
400	7,130,000	1,602,000	272,000	0.01125
450	6,340,000	1,498,000	254,000	0.01000
500	5,710,000	1,414,000	241,000	0.00900
550	5,180,000	1,344,000	229,000	0.00818
570	5,000,000	1,320,000	224,000	0.00789
600	4,750,000	1,288,000	219,000	0.00750

On the above basis, the cost on meters per M of 570 B. t. u. gas would be $0.0450.

Readjustment of Appliances

A change in heat value will necessitate a general readjustment in appliances. Taking this at $1.00 per meter, it amounts to approximately $105,000 on the basis of the equivalent of present consumption. This is about $0.00367 per therm if distributed over one year of production. 550 and 600 B. t. u. gas probably would require little readjustment, say 25%, and 500 B. t. u. gas say 50%. Since this is an initial expense and not a continuing one it is only mentioned but not included in the complete tabulation of costs.

The following table is a recapitulation of all the foregoing items which are properly included (see table at bottom of page):

The investment cost per M remains nearly constant, but cost per therm increases materially with a lowering in heat value. For a given amount of heat to be supplied if 570 B.t.u. gas is taken as 1.00, the ratios are as follows:

570	1.00
550	1.03
500	1.12
450	1.23
400	1.36
350	1.54

Effects of Changes in Specific Gravity of Gas

According to gas flow formulas usually used, the quantity of gas delivered by any pipe line varies directly as the pressure and inversely as the square root of the specific gravity. Since considerations of compression costs and leakage limit the maximum pressure which it is advisable to use, it will be assumed here that no change in pressure limits will be made.

No doubt much of the present distribution system is adequate for any change in gravity. This will be assumed to be the case in all services and enough additional of the distribution system to include, say, 25%.

The present investment in transmission and distribution mains and services is about $5,500,000 and may be considered adequate for about 5,000,000,000 cubic feet annual output. Taking fixed charges at 12% this makes $0.132 per M as the cost of distribution chargeable to mains and services for the present 570 B. t. u., 0.34 specific gravity gas.

Readjustment of Appliances

If a gas of 570 B. t. u. but of different specific gravity is sent out, a general readjustment in appliances will be required. Taking the cost of this at $1.00 per meter, it will amount to approximately $105,000 on the basis of present consumption. This is about $0.00367 per therm or $0.0209 per M when

Heat Value B.t.u.	Costs per Therm (Dollars) Storage	Compression (Inc. Sta. E)	Mains	Meters	Total	Cost Per M Dollars
350	0.01200	0.00772	0.0341	0.01287	0.06649	0.233
400	0.01050	0.00674	0.0305	0.01125	0.05899	0.236
450	0.00933	0.00600	0.0278	0.01000	0.05313	0.239
500	0.00839	0.00540	0.0255	0.00900	0.04829	0.241
550	0.00763	0.00490	0.0238	0.00818	0.04451	0.245
570	0.00737	0.00474	0.0232	0.00789	0.04320	0.246
600	0.00700	0.00450	0.0223	0.00750	0.04130	0.248

all charged to one year's production. A small change—say to 0.30 or 0.40—would probably require no readjustment, while change to 0.50 might require 50% readjustment and beyond that, 100%.

This item of cost in changing process is an initial expense only and the interest on the cost would be so small as to be less than the limits of probable error in the other items involved.

Capacity ratios are shown by the following table:

Sp. Gr.	$(\text{Sp. Gr.})^{\frac{1}{2}}$	$\frac{1}{(\text{Sp. Gr.})^{\frac{1}{2}}}$	Capacity Ratio
0.30	0.55	1.82	1.06
0.34	0.58	1.72	1.00
0.40	0.63	1.58	0.92
0.50	0.71	1.41	0.82
0.60	0.77	1.29	0.75
0.70	0.84	1.19	0.69
0.80	0.89	1.12	0.65
0.90	0.95	1.05	0.61
1.00	1.00	1.00	0.58

This makes the costs as follows considering that only the specific gravity is changed:

Sp. Gr.	Capy. Ratio	Investment Reg'd Dollars (75% of total)	Cost/M Dollars	Cost/Therm Dollars
0.30	1.06	5,270,000	0.126	0.0221
0.34	1.00	5,500,000	0.132	0.0232
0.40	0.92	5,860,000	0.141	0.0248
0.50	0.82	6,400,000	0.154	0.0270
0.60	0.75	6,870,000	0.165	0.0289
0.70	0.69	7,360,000	0.177	0.0310
0.80	0.65	7,720,000	0.185	0.0325
0.90	0.61	8,140,000	0.195	0.0342
1.00	0.58	8,490,000	0.204	0.0358

Combined Effect of Changes in Specific Gravity and Heat Value of Gas

In actual practice, it is quite possible that a change in one of these factors will involve a change in the other also.

The following table shows the combined effect under a wide range of conditions:

Cost Per Therm for Storage, Compression Distribution Mains, and Meters.

Sp. Gr.	B. t. u. 350	400	450	500	550	570	600
0.30	0.0643	0.0571	0.0518	0.0468	0.0433	0.0421	0.0401
0.34	0.0665	0.0590	0.0531	0.0483	0.0445	0.0432	0.0413
0.40	0.0691	0.0611	0.0557	0.0502	0.0464	0.0450	0.0431
0.50	0.0729	0.0645	0.0585	0.0529	0.0488	0.0472	0.0453
0.60	0.0763	0.0673	0.0612	0.0554	0.0510	0.0493	0.0475
0.70	0.0796	0.0701	0.0637	0.0580	0.0531	0.0514	0.0496
0.80	0.0828	0.0730	0.0659	0.0600	0.0550	0.0530	0.0514
0.90	0.0575	0.0753	0.0680	0.0618	0.0567	0.0549	0.0531
1.00	0.0882	0.0779	0.0700	0.0637	0.0584	0.0566	0.0548

The cost per M is easily determined from this table, since all that is necessary is to multiply by the number of therms per M; for example, the cost per M for 350 B. t. u. gas of 1.00 Sp. Gr.=30.9c./M, for 350 B. t. u. and 0.30 Sp. Gr.=22.5c./M, for 600 B. t. u. and 1.00 Sp. Gr.=32.9c./M, and for 600 B. t. u. and 0.30 Sp. Gr.=24.1c./M. These, by the way, are the limiting values.

Summary

The influence of heating value and specific gravity are found to be determining factors in the choice of gas plant owing to their influence on distribution costs. A combination of manufacturing methods seems to be indicated for most localities as best fitted to realize

(a) Minimum peak load investment
(b) Minimum annual operating cost

For Pacific Coast conditions, the choice seems to narrow down to coal gas for handling the base load and oil gas plant for handling peak loads. It seems to be further indicated that oil gas plant will always be profitable for handling peak loads with oil at any reasonable cost and therefore existing apparatus will not have to be scrapped.

There seems to be, moreover, no reason why conclusions contained in this paper will not hold true under Eastern conditions as with Pacific Coast conditions.

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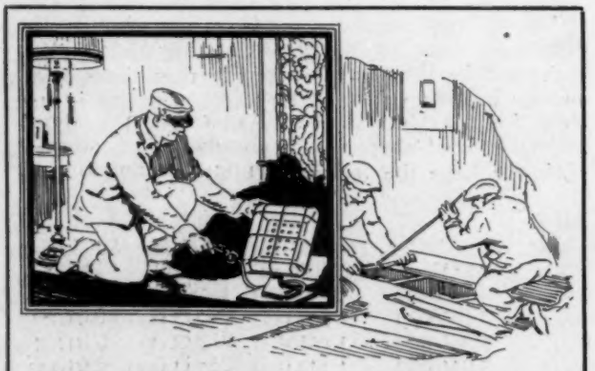

Would You Like to Have Your Floors Torn Up?

Of course not!... Then pipe for gas completely when you build.

Think ahead when you're planning your new house and provide for the gas appliances you'll eventually need. It's much easier to pipe the house completely at the beginning than to tear up floors later for extra piping.

Besides a kitchen range, you'll also want a gas water heater, gas room heaters—gas for the laundry and most likely, a gas furnace.

Consult our specialists and let us help you include adequate gas piping in the plans for your new house. Call .....for expert advice.

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"Pipe for Gas When You Build"

Gas News from England

Inspection service on industrial equipment builds business

C. H. S. Tupholme

Editor of the Gas Engineer

THE industrial gas load in Sheffield, the great center of the British steel industry, is one of the heaviest in the country, and a notable feature is the cordial co-operation between the Sheffield Gas Company and the steel manufacturers in the efforts to increase production and lower manufacturing costs. Gas is sold in Sheffield at 4d. per therm (100,000 B. t. u.), the calorific value of the gas being 500 B. t. u. per cu. ft. Though the steel industry has been depressed since the war, during the past few years over sixty gas-fired furnaces have been converted to gas. Gas is used in this city for, amongst other things, the manufacture of domestic stainless steel knives, and a typical battery of six furnaces turns out in a week of 40 hours 160 gross blades with a consumption of gas per battery per week of 80,000 cu. ft.

Other uses for gas in these industries are found in forging and hardening steel blades, where high pressure gas is commonly used; forging and hardening various steel articles and tools; annealing blades; forging and annealing files; heat treating safety razor blades; and tempering saws.

Gas Fired Hardening Furnaces

According to F. T. Rennison, industrial superintendent of the Sheffield Gas Company, for hardening various kinds of blades the gas burners are sometimes placed under the floor of the furnace to prevent actual flame contact with the material, and, providing the working temperature is not too high, this arrangement has been found to be a good one. On the other hand, if this positioning of burners is attempted for high temperatures, it will be found unsuitable because the maintenance cost for floor renewals will then be unduly high.

For forging, the burners are fitted at the top, back, sides or front of the furnace. On these furnaces the average consumption of gas works out at:

½ in. burner ..... 200 cu. ft. per hour
¾ in. burner ..... 350 cu. ft. per hour
1 in. burner ..... 600 cu. ft. per hour

The burners are supplied with air at a pressure of around 1 to 2 lbs. per sq. in.

On an eleven-day test on forging files with gas, 93 cwt. of files of various sizes and shapes were dealt with, using on the average 141 cubic feet of gas per hour, and the consumption of gas per cwt. of files worked out at 120.5 cu. feet.

Keeping Business

H. H. Creasey, manager of the special service section of the Gas Light and Coke Company, the undertaking which supplies gas to the greater part of the London area, tells how his concern devotes as much attention, if not more, to the question of keeping business as to getting new business. This company carried out an intensive campaign amongst doctors, architects and estate agents some time ago.

"In the first year I dealt with doctors," says Mr. Creasey, "it would be literally true to say that an order to maintain a gas fire was of far more importance than an order for a new one, because otherwise a large number of ghastly examples would have remained in use, frequently in the eye of the public, who, as a result, would have decided that the last thing they wanted to have was a gas fire, if the one they saw in use was a typical example."

Each year this company sends a letter to every doctor for whom either they maintained a gas fire or fires for the first time in the previous year, or for whom they have maintained fires for years. This letter is written in the form of a definite challenge, and contains these words:

"I hope that the periodical attention we are now giving is securing for you the health, comfort and convenience which gas fires can provide. Would you kindly advise me on the enclosed postcard whether this is so?

"Forgive my troubling you in this matter, but we want to know at all times of anything that might endanger your favorable opinion of gas heating."

Inducing Complaints

The postcard is stamped so as to induce a complaint if the customer has one to make, and only a very small proportion are returned with a complaint. On the contrary, the results obtained from these letters prove beyond question that the maintenance work both retains and gets business, because they bring in scores of testimonials, extracts of which are printed from time to time, and also requests for fresh business, also on the postcards.

An interesting aspect of the maintenance work carried out by the Gas Light and Coke Company is a system for the inspection and maintenance, or partial maintenance, of gas engines, and this scheme has become exceedingly successful. A staff is retained which does nothing else except inspect and deal with the adjustment and repair of gas engines.

Inspection Plan Develops Business

It may be claimed that the inspection and maintenance scheme has opened up a new field in industrial applications of gas for the Gas Light and Coke Company. They have recently examined and recorded all the apparatus in more than 7000 factories, and the additional business that has accrued owing to the inspection, overhaul and repair of consumers' out of date plant has been so enormous that they are continually adding extra representatives to handle the work.

The experience of this company shows that there is something to be achieved from the examination of almost every industrial plant to which their representatives gain access. They are always finding new opportunities for carrying out experiments, and find a great deal of plant in such an inefficient state that it is on the verge of being scrapped for some alternative form of heating.

A few years ago the Gas Light and Coke Co. started what they call a district ordinary consumers' inspection scheme, and this has now grown to such a state that a large staff does nothing else but call upon consumers to examine the whole of the gas apparatus on the premises. An average of 900 consumers are visited every week. This is how the scheme works, in the words of Mr. Creasey:

How the Plan Works

"The examiner's call is preceded by a letter advising the consumer that Mr. ——— will call in a few days for the purpose of giving advice and assistance regarding all the gas apparatus on the premises. We naturally do not profess to be the only Company carrying out such a scheme, but I would point out that the thing must be done thoroughly to be a success, and if due reward is to result therefrom.

"I know of one Company which originally carried out some such system as ours; but in my view they stopped short of the vital part of the scheme. Their letter, in effect, asked the consumer if he was satisfied with his apparatus, and stated that a representative would call to ascertain if this was so. When the representative called, if the consumer either left a message for him, or told him that he or she was perfectly satisfied, and the representative got a signature to a card stating this, and that was all. The letter did not definitely state that all the apparatus would be examined; and if the consumer said he was satisfied, the apparatus frequently was not inspected.

A Question of Satisfaction

"It does not matter to me that a consumer is satisfied. That is not sufficient. The consumer may be satisfied with something far short of our best. What matters is whether the expert representative is satisfied; and he cannot know this unless he carefully examines all the apparatus.

"The results which are obtained from our examination scheme are, I think, really astounding. Many appliances, both hired from the Company and owned by consumers, are overhauled and orders for periodical maintenance are obtained. Here again we see proof of the value of maintenance. Defective apparatus is first overhauled, and subsequently maintained. This apparatus is, you note, discovered to be defective by the examiner, and without his call it is obvious that it would have gone on in this defective condition until it became too bad to be tolerated (sometimes in sight of the relatives and friends of the consumer), when the consumer would either make a complaint or, as sometimes happens, do away with the appliance without giving us a chance to put it right."

The Still Multiflame Coke Oven *

Operating tests and fuel efficiency prove its value

Dr. H. Kuhn

THE new patented Still By-Product Coke Oven differs materially from the prevailing type of oven in the special arrangement developed for underfiring. The heating gases and air for combustion are not simultaneously injected and burned in one mass and at one place (see Fig. 1), but the process of combustion is divided and proceeds successively and uniformly at different elevations in the heating flues. This arrangement is achieved by means of an entirely new system developed for the injection of the combustion air. The air, instead of entering, as formerly, in a single, undivided mass at the base of the flue, is supplied in predetermined quantities, and is divided over the height of the flue, while the gas enters in one stream through a jet provided at its base. The division of the whole current of air is simply accomplished by means of vertical channels provided in the dividing walls separating the flues. Lateral ducts lead into the adjacent flues and serve as injectors for specific quantities of air at specified elevations.

Multiflame Combustion Flues

The constructive arrangement of this "multiflame" combustion flues is shown in Figures 2 and 3, representing, respectively, longitudinal and cross-sectional views of the heating flues. The sketches

*First part of article appearing in Das Gas und Wasserfach, translated especially for the American Gas Journal.

are only schematic; number, cross-section, spacing of the air inlets or ducts, etc., are, of course, subject to specific conditions governed by the projected height of the ovens.

Figure 4 shows the Still 4 m. Oven Battery of the Societe Lorraine Miniere et Metallurgique in Thionville (Metz) in course of construction; the lowest lateral air ducts are plainly visible, as are also the vertical air channels in the dividing walls between the heating flues.

The Combustion Process

The process of combustion in the "multiflame" system of underfiring varies coniderably from the former one-flame system. The gas coming from the channel g (see Figures 2 and 3) and entering the bottom of the heating flues through gas-jets f comes in contact with only a part of the entire combustion air admitted through the lowest pair

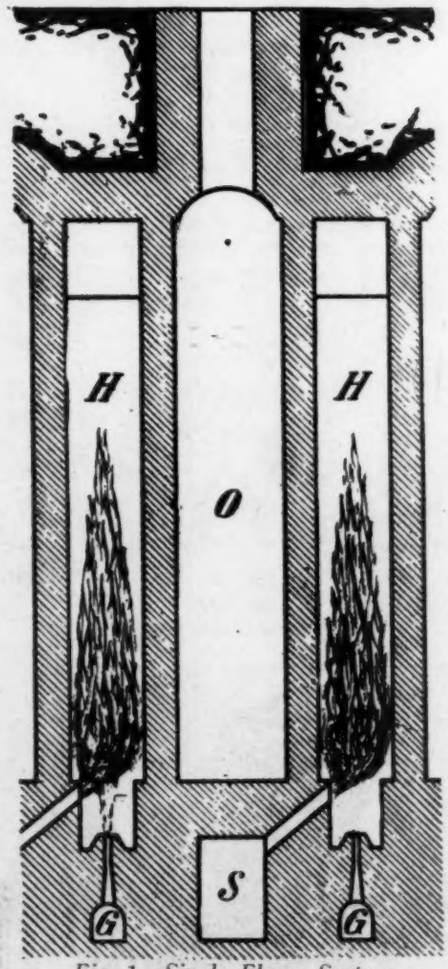
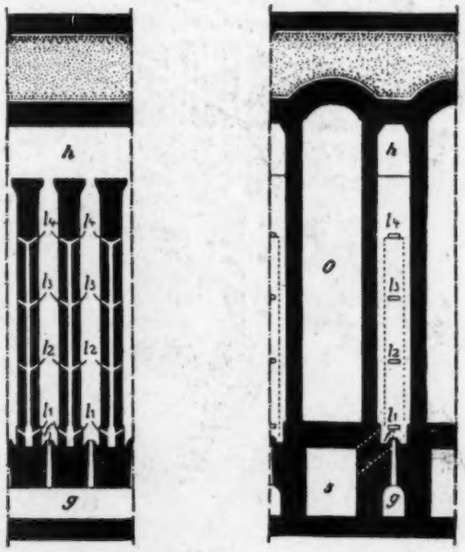


Fig. 1—Single Flame System

of air ducts l_1, located on the same level with the gas-jets. This portion of the air, which is insufficient for the complete combustion of the entire volume of inflowing gas, serves to burn only a proportionate quantity of the heating gas. The remaining unburned gas, together with the waste gases of the lowest combustion stage, flows upward in the heating flue. At the next air duct, l_2, arranged at a specified higher level, the unburned gas comes in contact with a second portion of the air, and again partial combustion takes place. The process continues until the highest and last air duct, l_5, is reached, and there the remaining air is consumed in burning the remaining gas. This completes the process; and combustion is complete because both



Figs. 2 and 3—Longitudinal View and Cross Section of the Still Oven Multiflame System

gas and air are supplied in the required volumes. Excess of air is practically precluded; only traces of oxygen are found in the horizontal channel.

Advantages of System

The multiflame underfiring system has different material advantages. Two of these advantages, substantiated by recent temperature readings, are discussed below.

In the first place, it is important to note that the vertical temperature drops, so characteristic of the one-flame heating system, are completely eliminated. It is well-known that the intensity of uniform heat radiation of the one-flame oven does not extend far enough sufficiently and uniformly to heat the upper parts of the oven. The temperature in these parts, therefore, lags behind the temperature below. Recourse to artificial contrivances to force uniform vertical heating (for example, admixture of waste gas with the heating gas, conical design of the heating flues and coking chambers, changes in the direction of the circulation of the heat, and so forth) could not counteract these variations in temperature, especially in the case of ovens of greater height. Attempts of this kind have usually resulted in other, unexpected disadvantages, such as partial loss of efficiency of heat radiation and pene-

tration, complicated and more costly construction, loss of useful space for coking, etc. These temperature drops in the one-flame, heated oven are not found in the Still oven, due to the very nature of the multiflame combustion. This system, by proper adjustment of the successive air supplies at definite elevations, and without recourse to auxiliary means for overcoming the temperature variations, can be applied to unusually high ovens.

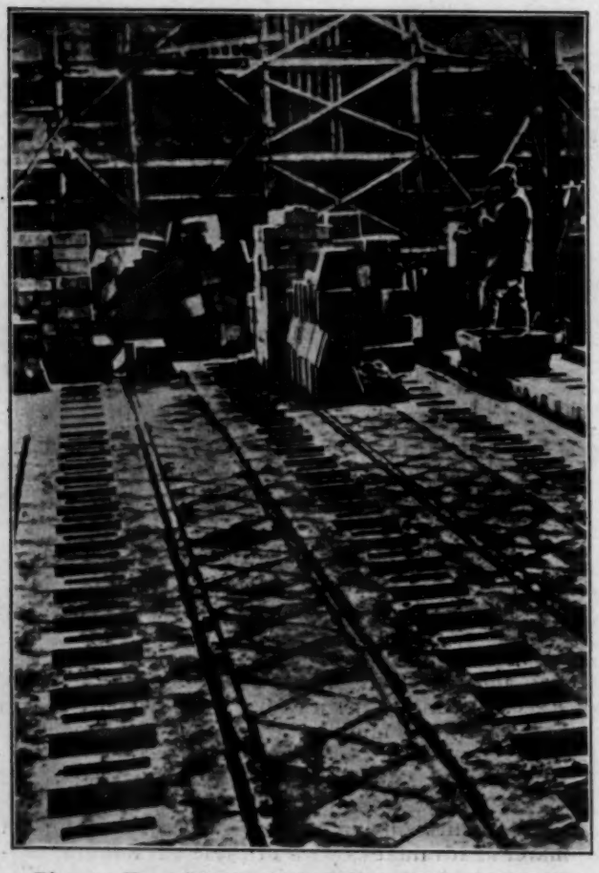


Fig. 4—Four-Meter Oven Battery (Soc. Lorraine Miniere et Metallurgique) in Course of Construction

Practical Tests

The uniform vertical heating of the multiflame-fired ovens has been proved by practical measurements. Two tests from a large number of reports, covering records of measurements of temperature taken in multiflame-heated ovens in continuous operation, are described below.

The first report covers the two Still coke-oven batteries completed in 1924 and 1925, respectively, for the "Kokswerke and Chemische Fabriken A. G." in Gleiwitz O. S. (Height of coking chamber 3 meters, mean width 0.40 meter, coking time 18 hours). The readings were taken at the end of the coking period by means of a Haase pyrometer inserted through the charging holes, after the coke was pushed out. They indicate therefore the temperatures of the heating walls. The upper point of measurement was directly under the abutment, while the lower one was immediately over the sole of the chamber (see Fig. 5 and Table 1).

TABLE I.
Temperature of Heating Walls of Still Coke Ovens with Multi-Flame Combustion at the Kokswerke & Chemische Fabriken A. G., Gleiwitz O. S.
(The Charging Holes are numbered commencing at the Pusher-Platform)

No. of Oven	Hole	Bottom	Top	Top plus	Bottom plus
66	1	1050°C	1045°C	—	5
	2	1090	1080	—	10
	3	1100	1100	—	—
	4	1060	1055	—	5
71	1	1045	1030	—	15
	2	1060	1040	—	20
	3	1060	1060	—	—
	4	1040	1045	5	—
91	1	1040	1040	—	—
	2	1075	1060	—	15
	3	1075	1070	—	5
	4	1050	1045	—	5
98	1	1065	1060	—	5
	2	1100	1100	—	—
	3	1100	1095	—	5
	4	1050	1050	—	—
101	1	1040	1040	—	—
	2	1065	1050	—	15
	3	1080	1075	—	5
	4	1050	1040	—	10
108	1	1030	1020	—	10
	2	1090	1080	—	10
	3	1100	1090	—	10
	4	1065	1065	—	—
111	1	1065	1060	—	5
	2	1075	1070	—	5
	3	1080	1070	—	10
	4	1050	1035	—	15
118	1	1065	1055	—	10
	2	1100	1080	—	20
	3	1100	1100	—	—
	4	1070	1070	—	—

The English Test

The second report covers readings taken at the Still Coke Oven Battery of the Powell Duffryn Steam Coal Co. Ltd., Bargoed, England, which was constructed in 1923-24. This battery was provided with rather wide, low coking chambers, and, accordingly, shows a longer coking period (height of chamber

(Continued on page 344)

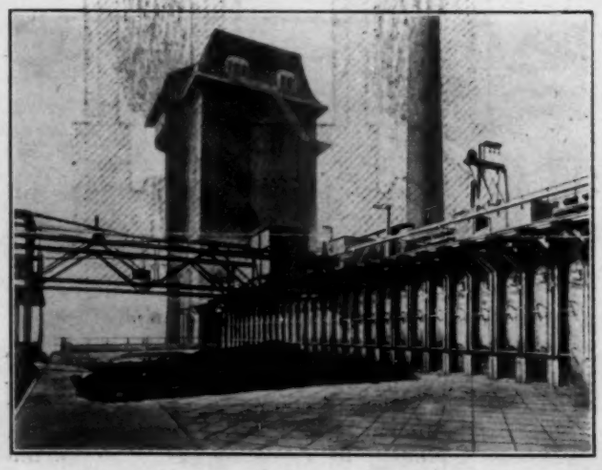


Fig. 5—Battery of "Still" Ovens at Gleiwitz, Germany

A Successful Customer Ownership Campaign

Canadian company has phenomenal success in selling securities

PHENOMENAL success in obtaining customer ownership was achieved by the British Columbia Electric Railway Company recently when the public of Vancouver and Victoria applied for nearly $7,000,000 of 6 per cent cumulative preference shares of the British Columbia Electric Power and Gas Company, a subsidiary, in five and a half days between March 15 and 20. The amount offered for sale was only $2,250,000 of which $1,500,000 was underwritten by a syndicate of local bond dealers and the remaining $750,000 allotted to employees to buy themselves or sell.

The employees of the company brought in no less than 10,851 applications for a total of $5,625,300 although the bond dealers sold their allotment at the same time. The employees' portion was therefore oversubscribed more than seven times. As the entire issue authorized was $5,000,000 less than $2,000,000 in applications will be refused.

A Record Made

The population of the territory served being only 350,000 this is believed to be a record, at least for a first customer ownership campaign.

Applications were limited to fifty shares and none were admitted from other than residents of the province of British Columbia.

It is believed that another record was made in the number of employee applications for shares. Out of a total of 2,985 permanent employees, including railway, power and gas departments, 1,410 applied for a total of $602,000. This amount is nearly two-thirds of the employees' allotment. More than 47 per cent of all employees are now shareholders. Shares were sold to the public at 99.

The B. C. Electric Power and Gas Company was incorporated to make customer ownership possible. The railway company is an English company and its dividends or interest payments are subject to English income tax which makes the ownership of its shares or stock in Canada not feasible. This was therefore the first effort towards customer ownership by the B. C. Electric Railway Company or any of its subsidiaries.

Great Demand For Stock

It was originally planned to open the sale on March 20, although incorporation of the new company was accomplished only on March 4. Knowledge of the incorporation and its purpose having spread, without any direct publicity campaign being started, there arose such a demand for stock that it was impossible to hold back the sale. Employees and brokers therefore were allowed to take applications on March 15, in spite of the fact that the main advertising of the campaign could not be advanced more than two days or to March 17.

The brokers' allotment was sold entirely in two days and the employee allotment practically in 24 hours. When the advertising began to be felt on the third day of the sale, applications doubled, pouring in that day to the extent of no less than $1,200,000.

In the official prospectus, March 31 was named as the date for the closing of subscription lists. When oversubscription was seen to be inevitable, this date was advanced to March 20 and employees were requested to solicit no new applications. Advertising was discontinued, a great deal of this, including car cards, posters, newspaper advertisements, being discarded unused. In spite of this, applications continued to pour into the company's offices. Employees were requested by their friends to try to have applications accepted. Begging letters were received even after the close of the campaign asking the company as a favor to sell the customer some shares. It was less a case of selling shares than taking orders.

Some Figures of Campaign

Some of the figures concerning the campaign are interesting:

The city of Victoria with a population of some 50,000 applied through employees for more than $1,000,000 or more than the entire employee allotment.

One department of the head office, the accounting department, with 187 employees, sold $700,000 worth of shares or almost the entire original employees' allotment.

Three hundred motormen and conductors on Vancouver city lines applied for $132,700 worth of shares themselves. This department also made 959 public sales amounting to $458,800.

Local newspaper comment declared that the oversubscription was an indication of the confidence in the integrity of the company. It was pointed out that no such public subscription had been received since the Victory loans of 1917, 1918 and 1919. It is believed that the offering was the largest ever made by a Canadian company through the medium of a customer ownership campaign and the oversubscription of this offering therefore creates a double record.

All previous financing by the British Columbia Electric Railway Company and its subsidiaries has been done in England. The president of the company is George Kidd, the head office being in Vancouver. The customer ownership campaign was in charge of William Saville, general secretary; E. H. Adams, comptroller, and James Lightbody, publicity manager.

"Gas House Heating in Small Communities"*

Experience has shown practicality of business

W. A. Burrell

Industrial Gas Engineer, Central Illinois Public Service Company, Springfield, Illinois

THE home is not a commercial institution but is a center of comfort and culture. The home owner gets his money in his business and spends a portion of it on his home. Any activity which tends to improve home life and home conditions is one of national importance.

The present problem is to educate the home owner in the use of gas for domestic heating. It may take as long for domestic gas house heating to replace coal as it took the auto to replace the horse on the public highway, or longer. Architects, consulting engineers, heating contractors, the press, and most of all, our customers, must be educated to gas as a source of heat in the home. Co-operation, exchange of ideas, lots of hard work, courtesy to competitors, these things, coupled with a realization of the splendid service we can render our customers in eliminating them from the labor of attendance, coal dust, dirt and ashes in the home, will in time bring respect and honor and profit as just rewards for our contribution to human life and happiness.

House Heating in Primitive Form

Until the last few years, the problem of heating the home was accomplished in the most primitive manner. Several hundreds of years were required to progress from the open fireplace to the wood burning stove, and then to the coal fired furnace. In every form of heating it was necessary to carry in the fuel, stoke the fire and carry out the ashes. It has only been within the last few years, with the advent of oil furnaces, that real comfort and convenience was possible in heating the home. Now comes the next step in the development of modern house heating—the use of gas.

Gas house heating is young in comparison with the age of the gas industry. This activity was tried out in some of the larger cities only a few years ago and it is only during the last eighteen months that it has been successfully used in the smaller communities. Gas plants serving the smaller communities do not have an outlet for the sale of gas in manufacturing industries and are therefore limited. The majority of such plants have a summer peak and therefore house heating in the winter time opens an entirely new field which they can adequately serve at off peak rates.

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*Presented before the Convention of Illinois Gas Association, March 17 and 18, 1926, Springfield, Illinois.

New Problems Presented

This new field presents many problems with which the operators of gas properties have not been familiar with in the past. No company should go blindly into this work without first carefully investigating this load and main conditions. A careful study and investigation should be made by each company before definite policies of operation are established. In selling, installing and operating twenty-seven installations during the past twelve months, the Central Illinois Public Service Company had many enlightening experiences, some of which confirmed the experiences of other companies and some of which were entirely new.

In selling the installations, practically no newspaper advertising or other publicity was used. In each town the salesman called upon a selected list of prospects and sold each installation by direct methods. This was found to be entirely satisfactory since pride of ownership was conducive to word of mouth publicity. Every installation was sold on its merits with full understanding by the purchaser that the cost of operation would be probably higher than any other form of heating but that it was the last word in modern house heating methods.

In every case a liberal estimate of the cost of heating with gas was made and supplied to the prospective customer. The actual bills received by the customers have been within the estimate in all cases except two. In these installations an error was made due to the estimate being based on the installed radiation instead of the required radiation. In the future, each job will be figured separately and all estimates based on the radiation required.

Gas House Heating, an Investment

It is repeatedly said by prospective customers, that gas house heating is a luxury. This is not the case; it is an investment. The average American home costs a thousand dollars per room, that is, five thousand dollars for a five room house; seven thousand dollars for a seven room house; and so on. When gas is used instead of other forms of fuel, a nice clean basement, free from ashes and dust is possible. The basement can be as clean and neat as the rest of the home. Is such a basement not equal to an extra room and easily worth a thousand dollars? In many homes where gas furnaces have been installed, this extra room has been furnished as a den or library, thus adding to the intrinsic value of the property.

(Continued on page 342)

As The Journal Views It

THE PLUMBER AND THE GAS COMPANY

The relation between the plumber, that is, the master plumber, and the gas company, has always been a close one, although at times, and under certain conditions, it has not been all that one would wish and expect it to be. In the past there has been exhibited a certain amount of resistance on the part of the plumber particularly to enter into friendly relations with the gas company. It is also true that certain gas enterprises did not see why they should cater in any way to master plumbers. Fortunately, this state of affairs has ceased to exist and today there are quite cordial relations between the master plumber and the gas company in practically all communities. These relations are growing better and better and it is with a great deal of interest that one reads that the efforts begun by the American Gas Association for bringing about closer co-operation between master plumbers and heating contractors on one hand and the gas company on the other hand, are bearing fruit. Such co-operation will redound only to the mutual benefit of all parties concerned and it is a pleasure to say that all have now been convinced of the fact that there is a great deal more to be gained by working together for mutual benefit than by being antagonistic and trying to injure one another.

It will be remembered that the Secretary-Manager of the American Gas Association, at the beginning of the present year, addressed an annual conference of presidents and secretaries of the National Association of Master Plumbers of the United States and the Heating and Piping Contractors of North America. In this address, he showed the way in which mutual understanding can be arrived at through the appointing of committees to consider acceptable plans for co-operation. This plan was universally adopted. It has formed the basis of further work along these lines.

Another interesting angle of the manner, relating to the way in which this plan is operating, is taken from the Master Plumbers' Journal entitled "The Ladle," in which an article, entitled "The Gas Company," after discussing grievances frequently expressed by both sides, says in part:

"This feeling could and must be eliminated. Every apartment house erected should be piped throughout for gas as well as most of our buildings. Appliances now are so perfected that they are not only safe but most attractive in appearance. Every fireplace should be equipped with a modern gas log or other gas heat giving fixture, which is not only cheerful but comforting.

"Gas fitting is a lost art due, in great measure, to our indifference. Let us try to revive this branch of our industry.

"We could increase the gas consumption through legitimate propaganda beyond the Gas Company's wildest dreams by advocating gas appliances to our clients.

"This is the age of constructive co-operation and it only requires the proposition to be put up to the Gas Company in an intelligent manner. They will soon see the logic of it, and let us all be boosters for more gas piping in every building, and when we can show them it is to their interest to work with us we can have anything within reason from them.

"Get a good live representative committee from our Association to call on the Gas Company and do it as soon as possible."

GAS—THE HOME LIFE INDICATOR

It is well known that in the past few years there has been a marked tendency for Americans to get away from home life. This has been true particularly in large cities, where the home has come to be merely a place in which to sleep and often does not even serve that purpose. This condition also exists to a certain degree in the smaller communities. Practically the only meal prepared in the home has been the breakfast and, at times, not even this meal is cooked in the dwelling place, misnamed the home. Of course, this had an effect on the consumption of gas, for such households will scarcely use any more gas in a month's time than what is consumed by the cigar lighter in a cigar store.

It is, therefore, of interest to read of statistics quoted by the Connecticut Committee on Public

Service Information which indicate that there has been a very marked increase in the consumption of gas for cooking and house heating purposes in that State, and that the 2.5% increase of gas sales throughout the state of Connecticut during 1925 was due mainly to this increase.

The Committee concludes, therefore, that people are remaining at home more and more, for the increase in gas meters installed during the same period was 1.8%. Thus, gas sales serve as an indicator of the manner in which Americans are living their lives. It is the index of the growth or decline of home life. And inasmuch as home life is of intrinsic importance in maintaining a high state of social morality those sociologists and publicly-interested people, who follow sociological developments in our country, will do well to study the manner in which gas sales vary from year to year. For, from it they will be able to learn to just what degree the American is returning to the home life of his forebears.

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GAS HOUSE HEATING IN SMALL COMMUNITIES

(Continued from page 340)

Another case of bad judgment was in installing a furnace in a customer's home that was not financially able to use gas for house heating. It would seem that gas house heating should not be installed in any customer's home unless that customer has an income of at least $4,000 per year. There may be some few exceptions to this rule, but we believe they will be very few.

Method of Installation

The installation of the furnace often determines whether or not it will satisfactorily heat the home. As an example, a lady had a warm air coal fired furnace installed in her home three years ago. This furnace did not heat the home satisfactorily and she complained to the heating contractor, who in turn went to the manufacturer. The manufacturer gave him instructions to take out this furnace and install a coal fired furnace two sizes larger. This was done but no better results were secured. We replaced this coal fired furnace with a gas warm air furnace and heated the house to her entire satisfaction. In installing the gas furnace, however, practically the entire system of piping in the basement was changed; cold air was added and the warm air pipes changed so as to obtain proper circulation.

Experience has shown that the managers of the gas companies should be thoroughly sold on gas house heating before trying to sell it to the public. Any luke-warmness on their part in talking to prospective customers will militate against the sales. Such employees should, whenever possible, install furnaces in their own homes as an example to their customers. Gas companies should also heat their own offices with gas fired furnaces which in many cases can be installed on the display floor, thus combining utility and publicity.

Lack of Complaints

It has been found that the cashiers await the coming of customers having gas fired furnaces with fear and trembling. These employees are used to having complaints on gas bills exceeding seven or eight dollars for cooking and at first are entirely unable to grasp the fact that the gas house heating customer has received full value for his money and is willing to pay for it. As a matter of fact, there has been practically no complaints caused by high bills where the service was adequate. The lack of complaints is also due, in no small part, to the exactness with which the original estimates were made.

Every gas company who has engaged in this activity has found it to be impossible to convert coal fired furnaces to gas fired. The construction of a coal furnace is such that it does not lend itself to the efficient use of gas, and economical operation cannot be obtained.

Air Leaks

Every home should be carefully inspected for air leaks before a gas furnace is installed. Especially open fireplaces should be protected by a throat damper or capped at chimney top. The owner should be

(Continued on page 346)

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Heat Your Home with Gas Fuel
SERVICE
Make your basement a recreation room. A gas-fired boiler will transform a dingy place into a useful extra room.
Dirt, dust, removal of ashes and the dirty storage bin need no longer be tolerated.
The gas-fired central heating plant, thermostatically controlled, furnishes clean heat at any desired temperature.
Right now is the opportune time to investigate gas house heating.
Our fuel experts will gladly make a survey of your premises. Write, call, or telephone, to the Industrial Division, 180 Remsen Street.
Telephone: TRIangle 7500
The Brooklyn Union Gas Company

A Basement Made into a Recreation Room When Gas House Heating Is Used

INDUSTRIAL GAS LESSONS

IF IT'S DONE WITH HEAT — YOU CAN DO IT BETTER WITH GAS

Lesson No. 115

Combustion

Lignite Coal

THE next coal, as far as age is concerned, is lignite. Lignite is older than peat, and while just a step removed from it, contains ingredients that are not found in peat and which make it a very different substance from peat. Lignite coal seems to have been formed from woody matters that were rich in resins. Lignite is non-fibrous and brown or black in color. The volatile matter, that is derived from lignite coal, is mixed with a large proportion of carbon dioxide. An average composition of lignite coal is as follows:

Carbon	From 50 to 65%
Combustible hydrogen	From 1 to 2%
Chemically combined water	From 20 to 30%
Moisture (hygroscopic)	From 10 to 25%
Ash	From 5 to 10%

Lignite coal is found in large quantities in this country in the States of the Dakotas, Texas, Louisiana, Mississippi, Colorado, etc.

Analysis of Lignite Coal

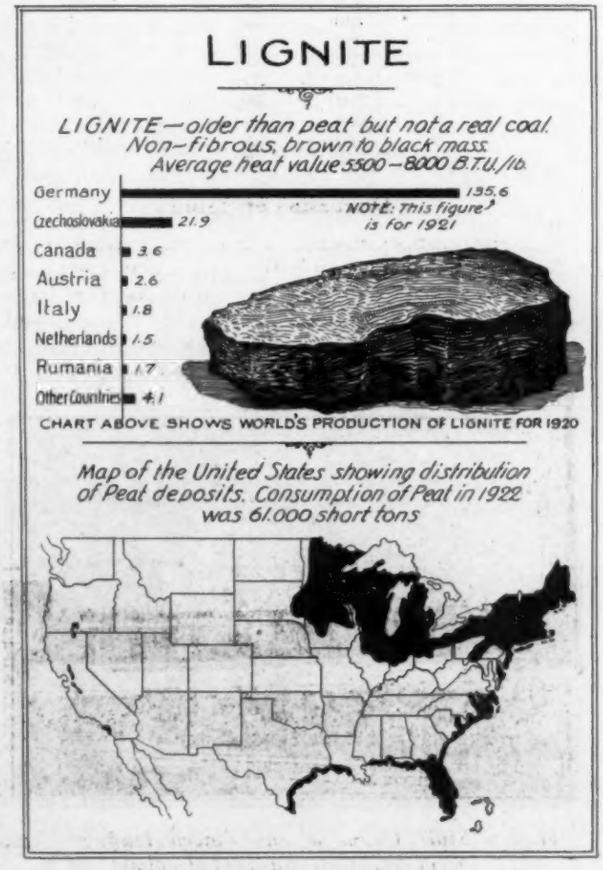
Analysis of a sample of lignite coal, obtained from Montana beds, is given below:

Volatile matter	52.91
Fixed carbon	47.09
Sulphur	1.53
Hydrogen	5.10
Carbon (total)	70.54
Nitrogen	1.53
Oxygen	21.50
Heating value	12,160 B. t. u. per lb.

The lignite coal as mined, generally has a heating value ranging from 5,500 to 8,000 B. t. u. per lb. When this is converted to the moisture and ash-free basis, it is found to correspond to from 10,000 to 13,000 B. t. u. per lb.

Great Supplies Available

Before leaving the subject of lignite, it must be mentioned that this type of coal constitutes about one-half of the world's resources of solid fuel. At the present time there is practically no production of lignite coal in the United States, but it is safe to say that the country's resources of lignite coal will become of considerable importance in the future and will be drawn upon largely to supply the demands for solid fuel when the higher grade coals become scarce. The illustration which accompanies this lesson shows, in part, the distribution and production of lignite coal in the year 1920. It is noticed that the German production of lignite coal is far in excess of the rest of the world's production of this solid fuel.


LIGNITE
LIGNITE—older than peat but not a real coal. Non-fibrous, brown to black mass. Average heat value 5500–8000 B.T.U./lb.
Germany 135.6
Czechoslovakia 21.9
NOTE: This figure is for 1921
Canada 3.6
Austria 2.6
Italy 1.8
Netherlands 1.5
Rumania 1.7
Other Countries 4.1
CHART ABOVE SHOWS WORLD'S PRODUCTION OF LIGNITE FOR 1920
Map of the United States showing distribution of Peat deposits. Consumption of Peat in 1922 was 61,000 short tons

THE STILL MULTIFLAME OVEN

(Continued from page 338)

2.55 meters, mean width 0.48 meter, coking time 26 hours). The same method of taking the readings was used (see Fig. 6 and Table 2).

TABLE II

Temperature of Heating Walls of Still Coke Ovens with Multi-Flame Combustion at the Powell Duffryn Steam Coal Co. Ltd., Bargoed (Wales) England. (The Charging Holes are numbered commencing at the Pusher-Platform)

No. of Oven	Hole	Bottom	Top	Top plus	Bottom plus
1	1	900°C	890°C	—	10
	2	920	910	—	10
	3	900	900	—	—
	4	890	880	—	10
2	1	910	900	—	10
	2	940	940	—	—
	3	925	930	5	—
	4	920	910	—	10
6	1	900	900	—	—
	2	930	925	—	5
	3	920	920	—	—
	4	900	890	—	10
11	1	960	960	—	—
	2	940	940	—	—
	3	960	960	—	—
	4	940	930	—	10
15	1	990	980	—	10
	2	990	980	—	10
	3	980	980	—	—
	4	960	960	—	—
38	1	940	940	—	—
	2	970	970	—	—
	3	980	970	—	10
	4	950	940	—	10
43	1	940	940	—	—
	2	980	980	—	—
	3	950	950	—	—
	4	940	940	—	—
48	1	900	880	—	20
	2	950	950	—	—
	3	960	950	—	10
	4	920	920	—	—

Discussion of Results

The difference in the vertical temperature lies, therefore, between 0 and 20°C., in exceptional cases reaching a maximum of 2% of the recorded temperature, or an average of barely 1%. This result is equivalent, in actual practice, to absolute uniformity of temperature, since the average variation of not quite 10° C., i.e., 1%, due to the varying timely and local conditions of operation, can hardly be improved upon.

It is important to note that both readings were taken under normal and continuous operating conditions. They are corroborated by numerous other readings taken from coke oven batteries, built on the principle of the Still multiflame combustion system.

The perfectly uniform temperatures of the heating walls at the end of the coking period correspond to the uniform temperatures taken during the progress of the coking process. Fig. 7 is a diagrammatic representation of the temperatures observed during the operation of the Gleiwitz plant. The readings represent temperatures in the lower and the upper parts of the coke cake, taken by means of thermo-couples on a center line 0.80 meter from the pusher platform side. It is plainly seen that during the entire coking period the coke cake was uniformly heated from top to bottom. The two temperature curves are very close together. They approximate a straight line, indicative of the uniform rise in temperature during coking. This result is noteworthy because the battery, at the time of taking the reading, was operated rather slowly, for the reason that the relation between coking period and by-product recovery was also being investigated. A similar test on an American one-flame heating system showed a fall in temperature of 298° C. at the end of the coking period.[1]

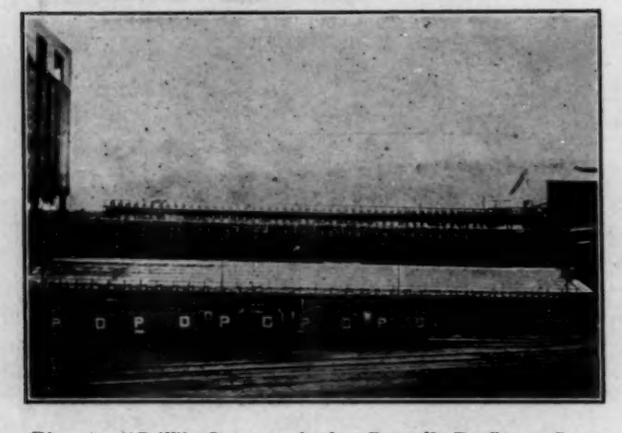


Fig. 6—"Still" Ovens of the Powell Duffryn Steam Coal Co., Ltd., Bargoed, England

Low Consumption of Fuel Gas

A further advantage, due to the uniform vertical temperatures, is the exceedingly low consumption of fuel gas in underfiring the ovens. This explains the large amount of surplus gas available. But, since the surplus gas is influenced by certain disturbing variables (easily proved by calculation), a far better standard of measurement—presupposing constant conditions, especially the same quality of coal—is the gas consumption for underfiring expressed in heat units for coking one kilogram of dry coal.

Gas Surplus and Thermal Value and Quantity of Gas Obtained

The following is a mathematical study of the relation between the gas surplus factor, the moisture and gas content of the coking coal and the thermal value of the coal:

G = Total yield of gas per ton dry coal 0° C/760mm. in m³,

G_1 = Total yield of gas per ton wet coal 0° C/760mm. in m³,

H_1 = Heating gas per ton wet coal 0° C/760mm. m³,

U_1 = Surplus gas per ton wet coal 0° C/760mm. m³,

f = Percentage of moisture in coal,

u = Quantity of gas in calories for underfiring and coking 1 kg. of dry coal,

h = Calorific value of benzol-free pas per m³ dry 10° C/760mm. in calories,

[1] Becker, loc. cit., page 881.

u = Proportional figure for surplus gas.

Applied to 1 ton of wet coal:

$G_1 = H_1 + U_1$ (Equation of volume).....(1)

Herein

$$G_1 = \frac{G\,(100—f)}{100},$$

so that the equation changes to:

$$\frac{G\,(100—f)}{100} = H_1 + U_1.$$

Proceeding from the calculation of the volume to the calculation of the calorific value, we have:

$$\frac{Gh \times (100—f)}{100} = H_1h + U_1h.$$

Composition of Heat Energy Consumed

The heat energy for coking one ton of wet coal H_1h is composed of the energy used for coking the coal and for evaporating the moisture. If the calories for evaporating one kilogram of water are assumed to be approximately 1000, then we have:

$H_1h = (1000—10f)\,u + 10\,f\,1000,$

$H_1h = 10\,[(100—f)\,u + 1000f].$

The above equation changes through insertion of this value and solution for U_1h to the following:

$$U_1h = \frac{Gh\,(100—f)}{100} —[10\{(100—f)\,u + 1000f\}].$$

The relation of the "surplus calories" to the total calorific value of the gas, or the relation of surplus volume is:

$$u = \frac{U_1}{G_1} = \frac{G_1—H_1}{G_1}$$

$$= \frac{\dfrac{Gh\,(100—f)}{100} —[10\{(100—f)\,u + 1000f\}]}{\dfrac{Gh\,(100—f)}{100}} .100$$

Simplifying this, we obtain the proportion of surplus, calculated in percent.:

$$100\,u = 100\left[— \frac{[1000\{(100—f)\,u + 1000f\}]}{Gh\,(100—f)} —\right] \quad (2)$$

The surplus gas varies therefore, even with the same requirements for underfiring—according to the gas contents and moisture of the coal and the calorific value of the gas.

Reason for Low Gas Consumption

There are various reasons for the low consumption of gas in underfiring the Still ovens. In the first place, the loss of heat, incurred in the one-flame ovens as a result of overcoking the lower portions of the coke-ovens, is completely eliminated through the uniform distribution of heat over the entire surface of the heating wall. This overcoking is unavoidable in the one-flame ovens, because of

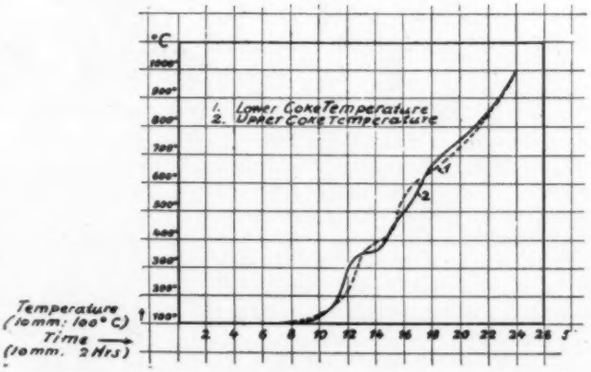


Fig. 7—Graphical Representation of Temperature Changes as per Table I

the necessity of "catching-up" in temperature to complete the coking in the upper parts of the chamber after the coke in the lower part is already done (see Porter "Coal Carbonization," New York, 1924). The overheating in one place and underheating in another, with subsequent additional heating to even up the two, is at best a wasteful method which accounts for most of the excess consumption of fuel in the one-flame ovens as compared with the multiflame ovens. The overcoking period is considerable at times. Becker[2] relates one case in which it lasted three hours, while Evans[3] mentions overcoking periods of eight hours. Then, again, those losses of heat which result from operative, mechanical or structural attempts or arrangements to force a uniform distribution of heat in the one-flame ovens, are avoided. A further saving of heat results from the fact that, due to the prolongation of the combustion process of combustion, the multi-flame heated ovens are practically operated without any excess of combustion air. The heat losses, which occur in the one-flame ovens, due to excess of air, are, therefore, eliminated. Finally, a further saving of heat can be realized in the multi-flame heated ovens, because, in case of especially high ovens, the practically constant radiation and convection losses refer to larger oven charges. The heat requirement per unit weight of coal is thereby correspondingly reduced.

(The concluding half of this article will appear in the April 24th issue.—Editor.)

An Attractive Range Exhibit —The One Article Plan of Window Display

[2] Porter, "Coal Carbonization," New York, 1924, page 243.

[3] Wilson, Forrest, Herty, "Thermal Operations of Modern Regenerator Coke Ovens," Industrial and Engineering Chemistry, 1923, page 251 et seq.

(Continued from page 342)

advised to install storm windows or weather strips wherever possible. Such precaution may seem like an unnecessary expense, but as a matter of fact, the saving in gas consumption will make the investment satisfactory. New homes which are built for gas house heating should be insulated with some form of insulation. There are a number of insulating materials now on the market which are designed for this purpose and are reasonable in cost.

In securing future business, a series of newspaper advertisements will be run consecutively in local papers in the gas towns served by this company. These advertisements will carry a cut of the homes of customers who are using gas house heating together with the house heating bills for the present heating season. The reason for running the heating seasons' bill is that every one admits gas heating would be fine if it did not cost so much. But when a customer sees his neighbor's house and knows what it costs, he knows immediately whether he can afford gas house heating for his own home. So far, this season, the actual costs have run under the estimate except for the month of October, during which the temperature was equal to the average November temperature of previous years. The bills for the month of January were under the estimates in about the same proportion as October were over, so the seasons' bills so far will equalize on the basis used for estimates.

Estimating Gas Bills

In estimating the seasons' heating bills we now figure the full season and divide the total bill in the following percentages for the different months. As an example, take an estimate of $425.00 for a seasons' heating bill, the monthly bills will, during a normal winter, be approximately as follows:

October	3.8%	$16.15
November	12.	51.00
December	19.	80.75
January	21.9	93.075
February	18.9	80.325
March	14.9	63.325
April	7.8	33.15
May	1.7	7.225
	100.00	$425.000

All installations should have thermostatic control and all hot water installations should have a water temperature control in addition to the room temperature control. It has been found in some installations where sufficient radiation was not installed, the water boiled in the system before the room temperature control shut off the gas. These controls are now considered standard equipment and are included in all estimates of original installation.

From the experience obtained this far, gas house heating seems to be entirely practical both from company's and customer's standpoint. It is a load which can only be developed gradually through the education of the customers. While every house is a problem in itself, it would seem that approximately 40,000 or 50,000 cubic feet of gas per room per heating season is required. In the majority of towns, a considerable number of customers can be served with existing plant facilities. Inasmuch as the company and the customer receive equal benefits, the proposition is economically sound.

HATE NOT YOUR GAS RANGE, SAYS DOROTHY DIX

Modern youth, the so-called enigma of the ages, holds no mysteries for Dorothy Dix, well-known writer, as those who have confided in her have discovered.

A man recently asked her advice on the attitude several of his girl friends had of not doing any housework after they are married. The girls considered housework tedious and drudge-like, something akin to slavery.

Miss Dix replied that there was nothing so pathetic as a woman who did not get joy from housework. A man finds his bread-winning job tedious and boring at times, yet to make provision for his deliverance from slavery is not to be thought of by the flappers.

"For it is the synthetic home, made with a can-opener and a paper bag by a woman on her way from a bridge party to a jazz dance that is largely responsible for the wandering husbands and hoodlum children, who do not stay at home because there is no real home in which to stay," says Miss Dix. "You can't imagine any happy family gathered about the breakfast nook in a kitchenette. Anyway, take this tip from me: Don't take a chance on marrying a woman who speaks blasphemously of a gas range."

NEW STAINLESS STEEL KNIVES MADE BY GAS

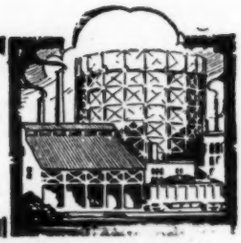
The manufacturer of stainless-steel table knives demands precision of heat-control, and to obtain this a factory producing 160 gross of stainless-steel blades a week has recently installed a complete gas-fired equipment for forging, hardening, tempering and tang-softening.

Formerly, in the production of steel knife blades, the temperature of the furnace was gauged by workmen looking through small holes at the color of the flames. With the development of stainless steel, pyrometers have come into general use to measure temperature, which must be held within narrow limits.

For forging, the steel is heated to 1,000 degrees Centigrade, and if this limit is exceeded the steel cracks. The blades are hardened in oil at 950 degrees C. Greater heat makes the blades brittle, and less heat fails to make them stain-resistant.

The entire process of forging, hardening, tempering and cooling 160 gross of stainless knife blades requires 80,000 cubic feet of gas, or less than four cubic feet to the blade.

NEWS OF THE GAS INDUSTRY



New England Gas Salesmen in Monthly Meeting

Listen to Talk on Merchandizing by S. D. Heed

Bringing out the important points that are necessary in the merchandising of household appliances, Mr. Heed told the one hundred and seventy-five members present at the April meeting, held on Friday, April 9th, at the Boston City Club, in a convincing and straight-forward manner, that in order to sell appliances, it is necessary to get out and meet the woman in the home and bring your message to her; also the highest type of salesmen are required and the salesman should be allowed to have what he earns, and if his commissions amount to more than the salary of the President or General Manager he is just so much more valuable to the company in putting out and on to the lines those appliances which consume more gas.

Mr. Heed said in part:

Merchandising of Appliances

"Merchandising of appliances, that is my topic, with the accent on the word MERCHANDISING. People don't buy gas of itself, they don't use gas just for gas, but for what it will do in the home or factory. Unless the gas burning appliances are in use you are not going to be able to sell gas. It seems to me that the fundamental point which confronts the gas industry is that it is necessary to sell more appliances in order to increase the gas business.

Competition

"I think I am safe in saying that there is a decided tendency in the gas companies to show a decrease in the output. You hear a number of people say that the gas company has no competition. But this is not the fact, we have a lot of competition. Public utilities are highly competitive and today the gas industry feels that competition about as keenly as the street railways.

"If there is a tendency to show a falling off in the gas output, we must busy ourselves and look around endeavoring to find a means of offsetting that tendency.

"To hold our volume and increase our output, we must constantly strive to sell to the homes those gas-using appliances. If we can put out enough of these appliances and increase our output to a large extent, we may be able to lower our prices, which would mean increased output.

Public Relations

"One of the best ways to maintain our output and possibly show an increase is the matter of public relations. We are all very anxious and very keen to maintain good public relations. Good public relations is the foundation stone of our business. There is no better way than to have satisfied users of the complete service that we are able to sell. If we have satisfied gas users, they will want more of our product, and we are in a good position to render service against competition.

Domestic Business Important

"Speaking of competition, think what we are up against. Take the bakery people for instance. The bakery salesman goes to the homes, he rings the door bell and tells the housewife that she ought to get out of doors and not stand around the hot kitchen baking bread, pastry, etc. What is the result, she buys the bakery product and therefore uses less gas for cooking. Take our friends in the food business, they are marketing more pre-cooked foods than ever before, which means a decrease in the gas consumption. Then there is the laundry man going from house to house soliciting business, either for the wet wash or flat work laundry. When a woman sends her clothes to the laundry you are losing considerable in gas output, because nearly every housewife today heats the water which is used for washing clothes with gas. In the house-heating field we have competition from the oil man and the coal man. And on top of all of this the electric companies are after us.

"The domestic business is the most stable business. People have to live, they have to eat and therefore have to cook and they do all of these things in the home. Your local factory, which uses gas, may shut down for a period because of lack of work, and you lose this consumption, but the gas used in the home is for every day of the year regardless of business conditions.

House Heating

"This question of house heating is quite a problem for the gas companies to solve. The further north you go the greater the load and the further south, the load is, of course, smaller. It is more or less peak load. It is a grave question if you can stand the investment necessary to take on this additional business. You have got to carry this investment over a period of twelve months. You should find something that will take care of this increased capacity during the time when it is not necessary to use gas for house heating. In Cincinnati we faced that proposition. We were all very much worried. We were in the natural gas business, but we found that our pipe lines were not large enough to take care of this extra increase, due to the house-heating installations, so we had to put in a plant for the manufacture of gas. Now the question arose whether or not that investment was justified when the output would be used only when the temperature dropped down to zero? You have a real problem. What does it mean to carry that investment? If you are taking on house heating, you must give thought and consideration that will offset the period when the house heating apparatus is not in use.

Industrial Use

"You have a slogan, 'If it's done with heat, you can do it better with gas'. Stick to that slogan and carry that message over. Don't let anybody talk you out of it. You ought to defy competition. We should take the position of recommending to the customer that which will do the best work for him.

Sales Effort

"My message to you is that organized sales effort is necessary in order to put into the home those appliances which will consume more gas.

"You have got to get out and ring door bells and sell these appliances, the people are not coming to your store and take them away from you in any great quantities. It is true that people do come to the appliance store and make a few purchases, but not enough to make any increase in your output. Therefore, it is absolutely essential to get out and do a selling job, which will put these gas consuming appliances on your lines.

Selling Is a Science

"Selling is an art or science with a very distinctive technique. In the selling science, you are dealing with the human equation, which calls for all the resourcefulness and tact which you can command.

"What is necessary to make a good salesman and what is necessary to carry this over to the customer to get the appliances in the home?

"The highest type of salesmanship is personal solicitation. You have to be neat appearing. You can't make a good salesman unless you have the right personality. Good salesmen don't grow on bushes.

"In order to merchandise appliances in volume you have got to sell direct to the consumer in the home. Today the story is being carried direct to the housewife and the chief talking point in the selling of gas appliances is the value of the service which they render to the housewife in her daily tasks.

Laundry Equipment

"I think the laundry in the home is being neglected, that is not enough selling is done on the laundry equipment for the home. If the customer uses an electric washing machine, it is necessary to have hot water and in practically every case the water is heated with gas. Then you have the gas-heated ironer and the gas heater clothes dryer.

Industrial Gas Men of New England Meet in Boston

Discussion Centered Around House Heating Problems

At April meeting of the Industrial Gas Division of the New England Gas Association, held in Boston, April 9, 1926, Kenneth G. Hamilton of the Fall River Gas Works, was voted in as a new member.

J. H. Sumner called the attention of those present to the value of the A. G. A. booklet, "Gas the Ideal Fuel," stated that he had bought a number of them to distribute to industrial gas users and recommended that others do the same. He also spoke of suggested changes in such summer courses as that given at M. I. T. and other colleges and universities for gas men. Instead of just a two-year course, it has been proposed that a longer course be given. He also spoke of the possibility of a traveling course designed especially to assist the smaller companies in securing industrial gas business. He mentioned the five-year program under consideration for trade paper advertising and pointed out that trade papers are now keen to secure trade magazine articles. He also touched upon rates and told of a suggestion made that there should be different gas rates for different industries. There are only 18 companies in this country, he said, that sell gas to the industries for less than 60 cents per thousand cubic feet. Their output, however, represents 13 per cent. of the total sold to industries.

Code for Domestic Boilers

J. J. Winn, Jr., of Fall River, brought up the matter of the code for domestic boilers. The code in Massachusetts is designed for coal fired boilers and does not fit the requirements of gas-fired boilers. For example, a fusible plug is required. This is all right in the case of coal for when the water level gets too low the fusible plug melts and the fire is quickly extinguished by the escaping steam. With coal this serves as a very effective safety device.

The same fusible plug is required in gas boilers. When the water level gets too low the plug melts and the gas fire is extinguished but the gas is not turned off. One danger is exchanged for another which is not good practice.

Both gas-fired boilers and coal-fired boilers in Massachusetts have to be rated on the grate area. This works satisfactorily for coal, but on account of the different principle used in designing the gas-fired boilers, it does not work out well with gas-fired boilers.

Wr. Winn made a motion that a committee be appointed to investigate the matter. This committee to confer with the manufacturers to learn their experience with the codes in the different states. After this committee has made a thorough investigation it is to report its recommendations back to the association toward the end that a suitable standard code may be suggested to the New England Gas Association and that association may take the necessary action to have the code adopted in the New England states.

The motion was carried, and J. J. Winn, Jr., of the Fall River Gas Works, Charles S. Hilton of the Pawtucket, R. I., Gas Company, and E. W. Berchtold, of the Boston Consolidated Gas Co., were appointed on this committee.

Open Forum on House Heating

There was no speaker at this meeting, which was thrown open as an open forum for the dicussion of house-heating problems. The first problem considered was the control of the temperature on the different floors of a three-story office building. A number of the New England Gas Company buildings are heated with gas. In these buildings the display floor is on the ground floor and the upper floors are used for comparatively small offices. The experiences

given by those present indicated that the only way to maintain an even temperature on all the floors is either through manual control or the use of thermostatic control on all the floors. If a thermostat is so located that the temperature throughout the building is uniform during the coldest weather, it will not be even during the comparatively warm periods of Spring and Fall. Different companies have placed the controlling thermostat in different locations, but none have found that one thermostat meets all requirements. It was the consensus of opinion that only with a thermostat on each floor could the temperature be held uniform automatically. In some cases more than one thermostat per floor seemed to be necessary. The plan and the location of the building has much to do with the number of controlling devices actually needed.

Estimating Small House-Heating Jobs

Some trouble has been found in estimating small house jobs, and experience denotes that it takes more fuel to heat a given cubical content in a small house than it does in a large one. No entirely satisfactory explanation was brought out for this fact. Even when the construction of the building was taken into account and due allowance made for the glass area, it has been found that in a house under 300 square feet of radiation a considerable percentage must be added if the actual consumption is not to exceed the estimate by a very considerable amount. Where 500 or more square feet of radiation is required the formula used shows accuracy and it is also quite accurate between 300 and 500 square feet of radiation. Some companies, after taking into consideration every possible heat loss, add at least ten per cent. to their estimate. One company that has made estimates on 39 boilers has found that the actual consumption on these boilers is within plus or minus two per cent. of the estimate. There are a few other boilers this company has installed where the actual consumption does not come as close as this because the customer is heating parts of the house he never heated before and did not plan to heat when the estimate was made or carries a higher temperature than the estimate called for. The experience given by those present indicates that the majority of the gas companies in New England doing any great amount of gas heating, have been able to estimate to within five or ten per cent. of the actual consumption after the boiler is installed, except in those case where in practice the heat is used in a different manner than it was planned to use it.

The Load Factor

A considerable discussion followed on the load factor of house heating. A number of companies find that the peak load comes at night. During the discussion it was brought out that it is important to study the load curve of the plant. Curves should be plotted before much house heating is secured and annually thereafter. One company has found that business it has been taking on unconsciously has had a decided effect on the load curve. Had the curves not been plotted and compared from year to year it would have been taken for granted that the industrial load had caused the change. Without plotting curves and making certain just what causes the change in the curve house heating will be blamed for undesirable changes when it is not the cause at all.

Periodic Inspections

Another matter brought up was the question of standardizing periodic inspections so that the same practice would be observed in all cities. This suggestion was countered by the expression of opinion that inspections were largely a matter of policy with the individual gas companies. Some companies like to give very frequent inspections, not because they are needed, but as a part of the sales policy. They find that if no service calls have to be answered the customer sells heating installations to their friends. Every service call makes it just so much harder to sell new installations. Therefore, weekly or monthly inspections are given to prevent service calls, and to lessen the sales resistance to gas-fired boilers. One company has made it a practice to make weekly inspections during the first year of an installation, monthly inspection the second year and a fall and spring overhauling the third year and thereafter. It has found that this pays, because until the customer has become accustomed to his plant he appreciates very much the attention that is given him. These weekly inspections also help to keep the actual consumption closer to the estimated because if too high room temperatures are being carried or heat is wasted in any other way the customer can be told before he gets his gas bill. After he has used his plant for a couple of years no such attention is required.

* * *

Large Gas Merger in Kansas

Independence, Kan.—A merger of twenty gas companies into a $10,000,000 corporation under the control of the Southwestern Gas Company, with headquarters in Independence has been announced.

The companies comprising the merger now supply cities from Olathe, Kan., on the north to Skiatook, Okla., on the south.

The name of the company has not been officially selected but all the other details have been completed, it was announced. The first purchase made by the company was that of the Owen-Osage Gas & Oil Company at Caney, which gives the company control of much of the Osage Indian nation gas supply, one of the largest in the world. The companies engaging in the merger are as follows:

Owen-Osage and Gas Company, Osage Gas Producing Company, Tulsa Gas Producing Company, Caney Pipe Line Company, Caney Natural Gas Company, Osage Oil Land and Development Company, Evidence Oil Company, Owen Gasoline Company, Southwestern Gas Combpany, Southwestern Utilities Corporation, Independence Gas Transporting Company, Olathe Gas Development Company, Southwestern Public Service Company, Coffeyville Gas and Fuel Company, Olathe Gas Distributing Company, Spring Hill Gas Company, Union Gas and Fuel Corporation, Altoona Gas Company, Fredonia Gas Company, and Kasigan Gas Company.

Brooklyn Gas Men Listen to Talks on Gas Subjects

Brooklyn, N. Y.—The third, in a series of talks on the gas industry, was given in the auditorium of the Young Men's Christian Association at Hanson place last evening.

Thomas P. Payne, auditor of the Brooklyn Union Gas Company, spoke on the accounting department of his company. Mr. Payne told how the accounting was done for all of the costs of the manufacture and distribution of gas and to what accounts the various items were charged.

George M. Kirchmer, claim agent of the Brooklyn Union Gas Company, one of the board of managers of the Self Insurers Association of the State of New York, and who serves upon the Law Committee of that body, spoke interestingly about the administration of the Workmen's Compensation Law in this state. He told how the law was framed and prepared by commissions of laboring men, lawyers and judges and finally in 1914 was established as the law in this state. He spoke of the various amendments and of the fact that at the present time a committee has been appointed by the Legislature to revise the Compensation Law.

This fact was brought about, said Mr. Kirchmer, because two hundred and ten amendments to the act were proposed during the present Legislature. The Legislatures thought that if a law had to be amended two hundred and ten times it would be better to consider the preparation of a new law.

Emil J. Bartel, superintendent of the meter department of the company, told about the construction of the meter and the way a meter worked and told about the costs to keep the meters in the district in repair when they are damaged.

The talks were illustrated by pictures. The pictures showed various men and workers in the Brooklyn Union Gas Company system at their tasks and were appreciated by the audience present, some of them recognizing themselves in the pictures.

* * *

Fulton County Gas & Electric Co. Increase Capitalization

Albany, N. Y.—Fulton County Gas & Electric Company, Gloversville, N. Y., has filed a certificate in the office of the Secretary of State increasing its number of shares from 31,576 shares of $100 par value to 100,000 shares non par value.

Gas Men to Assemble on Million Dollar Pier

Greater and Better Convention and Exhibition Promised

Announcement from headquarters office of the American Gas Association that the eighth annual convention and exhibition of the association would be held October 11 to 15 on the Million Dollar Pier, Atlantic City, N. J., instead of the Steel Pier, as heretofore, has met with instantaneous favor.

The Million Dollar Pier has been the scene of some of the world's largest conventions. It is 1,750 feet long, has the largest dance floor of any pier in Atlantic City; is located in the heart of the ocean front hotel district and is famed for its fish hauls, which are daily attractions, and for the excellence of its appointments. Originally, the pier was 2,250 feet long, but storms years ago washed away 500 feet of it.

An investigation of the pier last week by two staff members of the association revealed the fact that it had been entirely redecorated, with new lighting equipment installed in the ballroom.

As the scene of the association's eighth annual convention, the pier offers unexcelled opportunities for putting on the biggest and best meeting of gas men ever held. Some of the more important advantages are these:

All meeting rooms and exhibit space are under permanent cover, from one end of the pier to the other.

Young's Pier at Atlantic City, Where the 1926 Convention and Exhibition Will Be Held